Ishaan Bhadoo

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Education

Trinity College, University of Cambridge - MASt in Mathematics (Part III of the Mathematical Tripos, Oct 2024 - July 2025).

Relevant coursework: Advanced Probability, Mixing Times of Markov Chains, Information Theory, Functional Analysis, Additive Combinatorics, Analysis of PDEs.

Next Term: Random structures in finite-dimensional spaces, Stochastic Calculus, Concentration Inequalities, Entropy methods in combinatorics, Geometric Group Theory.

Indian Statistical Institute, Bangalore - Bachelor Of Mathematics (Honors, Sept 2021 - May 2024).
GPA: 94.16%; Math GPA: 96.57%.

Projects

ETH Zurich, Zurich, Switzerland
Research project in Prof. Vincent Tassion's Group (Aug 2024 - present)

- Ongoing collaboration with a PhD student in Prof. Tassion's group, studying the problem of percolation of words. The project's goal is to show that there are no exceptional words in site percolation on a transitive non-amenable graph.

Tata Institute of Fundamental Research (TIFR), Mumbai - Visiting Student
As part of a research program under Prof. Subhajit Goswami. Worked on Percolation Theory (May 2024 - July 2024)

- Studied the theme of interpolation in percolation theory. Read the theory of enhancements and covering maps in percolation. Using ideas from S. Martineau and F. Severo's paper showed that for d-regular quasi-transitive graphs G, $p_c(G) = \frac{1}{d-1}$ holds only for trees. Gave counterexamples for the non quasi-transitive case. Gave a talk at TIFR, the slides for my presentation can be found here. An article describing my work can be found here.

- Read through Hugo Duminil Copin's notes on the Ising model. More specifically understood the theory of random currents and its application to prove continuity and sharpness of the Ising model.

International Centre for Theoretical Sciences (ICTS-TIFR) - Summer Student
As part of a summer research program at ICTS under the guidance of Prof. Riddhipratim Basu, Prof. Anirban Basak (May 2023 - July 2023)

- Worked through Tom Hutchcroft's paper, which settled the famous Benjamini-Schramm conjecture about the uniqueness of infinite clusters ($p_c = p_u$) in the hyperbolic setting. Read Lyons and Peres' book Probability on Trees and Networks. Covered the necessary prerequisites in percolation theory, hyperbolic geometry, and functional analysis. Had weekly presentations with instructors and wrote a project report providing additional insights and filling in the details. Gave a presentation at the end of my stay at ICTS. The slides for my presentation can be found here. My project report can be found here.

Indian Statistical Institute, Delhi - Directed Reading Project
Reading project understanding the asymptotic behavior of maxima of a sequence of random variables under the guidance of Prof. Antar Bandyopadhyay at ISI - Delhi (June 2022 - August 2022)

- Studied the proof of the Fisher-Tippet-Gnedenko theorem, following Billingsley's "Probability and Measure". Studied measure theory, convergence of random variables, the Borel-Cantelli lemmas, weak convergence, the strong and weak law, central limit theorem, extreme value distributions, and Kolmogorov's theorems. Twice a week discussions with Prof. Bandyopadhyay.

Academic Achievements

Trinity College Scholarship, Trinity College, University of Cambridge - Full funding covering tuition, living expenses, and an additional research stipend.

Oxford-Cambridge Society of India Scholarship - Award of £2000 and membership of the OCSI. Details about the society can be found here.

Visiting Students' Research Programme - Selected for VSRP-2024 for summer research at TIFR, Mumbai. 19 students selected for mathematics nationwide.

Dean Fellowship - University of Maryland, College Park - Received the Dean Fellowship of 5000 USD (for the first two years), to pursue a Ph.D. in mathematics at UMD. *Declined due to the offer from Cambridge.*

International Tuition Award, Departmental Award - University of British Columbia, Canada - International tuition award of 3200 CAD per year, and the deparmental award from the department of mathematics of 1500 CAD to pursue MSc in mathematics at UBC. *Declined due to the offer from Cambridge.*

S. N. Bhatt Memorial Excellence Fellowship - Received the SN Bhatt Memorial fellowship for summer research at ICTS. 20 students were selected for the fellowship, 6 in mathematics. Awarded 30,000 INR stipend along with travel and living expenses.

All India Rank 10, Madhava Mathematics Competition - Selected for the MMC camp with an All India Rank of 10.

Indian Statistical Institute Studentship - All India Rank 26 in the ISI entrance exam. Full financial support with no tuition fees, a stipend, and a contingency grant for the B.Math program.

Regional Mathematical Olympiad Awardee 2019 - Cleared RMO 2019 and selected for the INMO being among the top 30 students.

Other Academic Activities

Notes on the Ising and Potts Model

- A comprehensive study of the Hugo-Duminil-Copin's notes on the Ising and Potts model. Topics Covered: Kesten's theorem, proof of subcritical sharpness, OSSS inequality, random currents, Russo-Seymour-Welsh theory, dichotomy for continuity of the Potts model, connections to integrable probability and the six-vertex model, conformal invariance.

Indian Statistical Institute, Bangalore - Probability Reading Seminar

- Details: Reading seminar organized by Prof. Parthanil Roy, involving undergraduate students, Ph.D. students, research scholars, and professors. Understood the theory of supercritical percolation beyond the euclidean setting, particularly the non-amenable case. Presented Jonathan Hermon and Tom Hutchcroft's paper as a 3 talk series.

Course Audits

- **Percolation Theory** (M.Stat 2nd year course, ISI, Delhi). Instructor: Prof. Rahul Roy.
- **Analysis of Graphs**, **Differential Topology** (ISI, Bangalore).
- **Measure Theory** for graduate students (ISI, Bangalore).

Madhava Mathematics Competition Camp (Chennai Mathematical Institute, 2021) - Offered to certain students based on their performance in the exam. 60 students were selected from the country. The website for the program can be found here.

Indian National Mathematical Olympiad Training Camp (INMOTC, 2019) - 2 week-long training camp to prepare for the national olympiad.

Talks

Part III Student Seminar - "Percolation of Words" (December 2024)

Tata Institute of Fundamental Reasearch, Mumbai - "Percolation under coverings" (June 2024)

Mathematics club, ISI Bangalore - "Percolation at criticality for graphs with exponential growth" (Sept 2023)

International Centre for Theoretical Science, Bangalore - "Percolation on Hyperbolic Graphs" (July 2023)

ISI-SNU student talk series, Shiv Nadar University, New Delhi. - "Conformal Invariance in 2D percolation" (Oct 2023)

Selected Conferences Attended

Geometry in Groups, ICTS Bangalore (29th July - 2nd August 2024) - The website can be found here.

Topics in High Dimensional Probability, ICTS Bangalore (2nd January - 13th January 2023) - The website can be found here.

Symposium on combinatorics and probability (30 April - 1 May 2022) - The website can be found here.

A conference on Probability and Stochastic Processes (29 - 31 March 2022) - The website can be found here.

Teaching Experience

Indian Statistical Institute, Bangalore - Undergraduate Directed Group Reading Program Mentored B.Math 1st and 2nd years during winter 2022 and summer 2023 in the following topics:

- **Field and Galois Theory (Nov-Jan 2022).**
- **Martingale Theory (May-July 2023, Joint with a Ph.D. student at ISI).**